

B1

- As illustrated in Fig. 1, five items are placed in the 32-word stack 10: A, B, C, D, and E in the order shown. With item E on top of the stack, the content of the stack pointer 20 is 5 (i.e., '00101' in binary). To insert a new item, the stack storage 10 is "pushed" by storing the new item into the location indicated by the stack pointer 20 (i.e., the location at address '5') and then incrementing the stack pointer 20 so as to point to the next-higher order location at address '6'. For removal of the top item E at address '4', the stack storage 10 is "popped" by decrementing the content of the stack pointer 20 first and then retrieving the top item E from the location at address '4', so that the stack pointer 20 contains '4' to indicate the top location. - -

A marked-up version illustrating the changes to the above paragraph is annexed hereto

Please replace the title of the invention with the following:

-- APPARATUS FOR CONTROLLING MULTI-WORD STACK OPERATIONS USING A
MULTI-BANK STACK IN DIGITAL DATA PROCESSORS --

IN THE CLAIMS:

Please amend the claims as follows:

- B2
1. (Amended) A hardware stack, comprising:
a stack storage comprising a plurality of banks each comprising storage locations; and

B2
a stack pointer circuit comprising a bank pointer for each bank, wherein each bank pointer points to a storage location of a corresponding bank, and wherein the stack pointer circuit is responsive to at least one control signal to insert bank address data in at least two bank pointers to perform a multi-word push or multi-word pop operation.

2. (Amended) A digital data processor, comprising:
an instruction decoder for decoding an instruction and generating a plurality of decoding signals;

a stack storage comprising a plurality of banks each comprising storage locations for storing stack items;

a plurality of stack pointers, the stack pointers comprising a main stack pointer for pointing to a top location of the stack storage and a bank pointer for each bank, wherein each bank pointer points to a storage location of a corresponding bank based on the content of the main stack pointer; and

a controller responsive to at least one of the decoding signals for inserting bank address data into at least two bank pointers to perform a multi-word push or multi-word pop operation.

3. (Amended) The digital data processor of claim 2, wherein each location is configured for storing a one-word item.

4. (Amended) The digital data processor of claim 3, wherein a two-word item is one of inserted into and removed from two adjacent locations at a given time.

5. (Amended) The digital data processor of claim 4, wherein said controller either increases or decreases the content of said main stack pointer by one when the decoding signals indicate a one-word stack operation; and wherein said controller either increases or decreases the

B2
content of said main stack pointer by two when the decoding signals indicate a two-word stack operation.

6. (Amended) A digital data processor, comprising:
a stack storage including a plurality of locations, wherein each of the locations of said stack storage are assigned to one of a first bank and a second bank;
a main stack pointer for pointing to a top location of said stack storage;
a first bank stack pointer for pointing to a location assigned to said first bank;
a second bank stack pointer for pointing to a location assigned to said second bank;
an instruction decoder for decoding a stack-based instruction and generating a plurality of decoding signals, each of the plurality of decoding signals denoting one of a one-word push operation, a one-word pop operation, a two-word push operation and a two-word pop operation;
and
a stack pointer control logic circuit for controlling said first and second bank stack pointers in response to at least one of the decoding signals to insert bank address data into the first and second bank stack pointers based on the content of the main stack pointer to perform a multi-word push or multi-word pop operation.

7. (Amended) The digital data processor of claim 6, wherein said stack storage comprises 2^{n+1} locations, n being a positive integer, and wherein the first bank and the second bank each include 2^n locations.

B3
9. (Amended) A digital data processor, comprising:
a stack storage including a plurality of locations, wherein each of the locations of said stack storage are assigned to one of a first bank and a second bank;
a main stack pointer for pointing to a top location of said stack storage;
a first bank stack pointer for pointing to a location assigned to said first bank;

23

a second bank stack pointer for pointing to a location assigned to said second bank;
an instruction decoder for decoding a stack-based instruction and generating a plurality of decoding signals, each of the plurality of decoding signals denoting one of a one-word push operation, a one-word pop operation, a two-word push operation and a two-word pop operation;
and

a stack pointer control logic circuit for controlling said first and second bank stack pointers in response to at least one of the decoding signals to insert bank address data into the first and second bank stack pointers based on the content of the main stack pointer to perform a multi-word push or multi-word pop operation, wherein said stack pointer control logic circuit includes:

an adder for adding one of plurality of predetermined integers to a content of said main stack pointer in response to a first decoding signal from said instruction decoder;

a first selector for selecting for output one of the content of the main stack pointer and a content of said adder in response to a second decoding signal from said instruction decoder, wherein the output of said first selector comprises a high-order bit portion and a low-order bit portion;

a first control logic for generating a first control signal in response to the low-order bit portion of the output from said first selector and a third decoding signal from said instruction decoder;

a second control logic for generating a second control signal in response to the low-order bit portion of the output from said first selector and a fourth decoding signal from said instruction decoder;

an increment logic for incrementing the high-order bit portion of the output from said first selector;

a second selector for selecting one of the high-order bit portion of the output from said first selector and the output of said increment logic in response to the first control signal; and

B3

a third selector for selecting one of the high-order bit portion of the output from said first selector and the output of said increment logic in response to the second control signal;

wherein the outputs of said second and third selectors are provided to said second and first bank stack pointers, respectively.

B4

17. (Amended) A digital data processor, comprising:

a stack storage including a plurality of locations, wherein each of the locations of said stack storage are assigned to one of a first bank and a second bank;

a main stack pointer for pointing to a top location of said stack storage;

a first bank stack pointer for pointing to a location assigned to said first bank;

a second bank stack pointer for pointing to a location assigned to said second bank;

an instruction decoder for decoding a stack-based instruction and generating a plurality of decoding signals, each of the plurality of decoding signals denoting one of a one-word push operation, a one-word pop operation, a two-word push operation and a two-word pop operation; and

a stack pointer control logic circuit for controlling said first and second bank stack pointers in response to at least one of the decoding signals to insert bank address data into the first and second bank stack pointers based on the content of the main stack pointer to perform a multi-word push or multi-word pop operation, wherein said stack pointer control logic circuit comprises:

an adder adds one of a plurality of predetermined integers to a high-order bit portion of a content of said main stack pointer in response to a first decoding signal from said instruction decoder;

a control logic for generating one of a first, second, third, and fourth control signals, and combination thereof, in response to a low-order bit portion of the content of said main stack pointer and a second decoding signal from said instruction decoder;

34
a first selector for selecting one of the high-order bit portion of the content of said main stack pointer and an output of said adder in response to the first control signal;

a second selector for selecting one of the high-order bit portion of the content of said main stack pointer and the output of said adder in response to the second control signal; and

a third selector for selecting one of the high-order bit portion of the content of said main stack pointer and the output of said adder in response to the third control signal;

wherein outputs of said second and third selector are provided to said second and first bank stack pointers, respectively, and the low-order bit portion of the content of said main stack pointer is controlled by the fourth control signal.